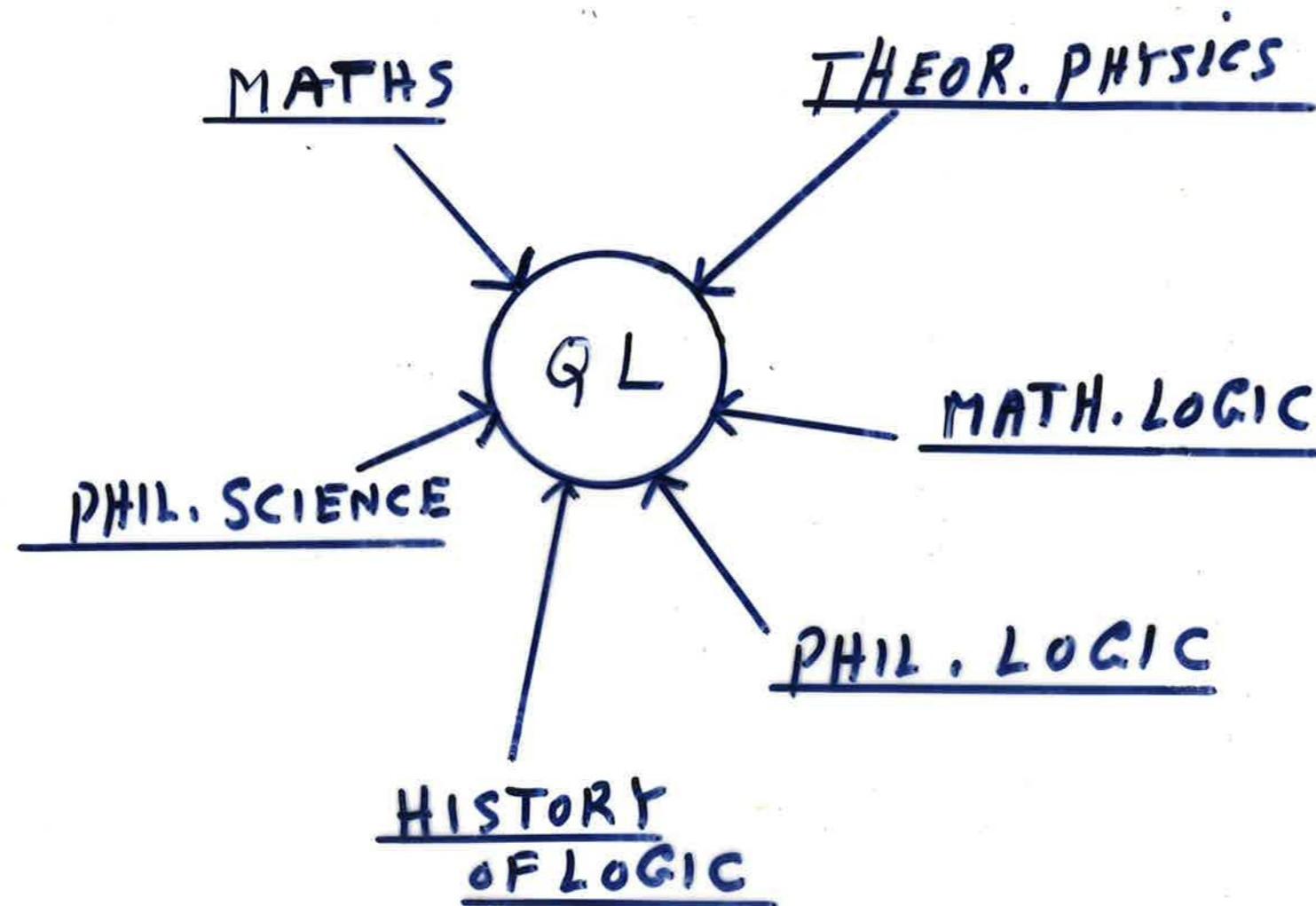


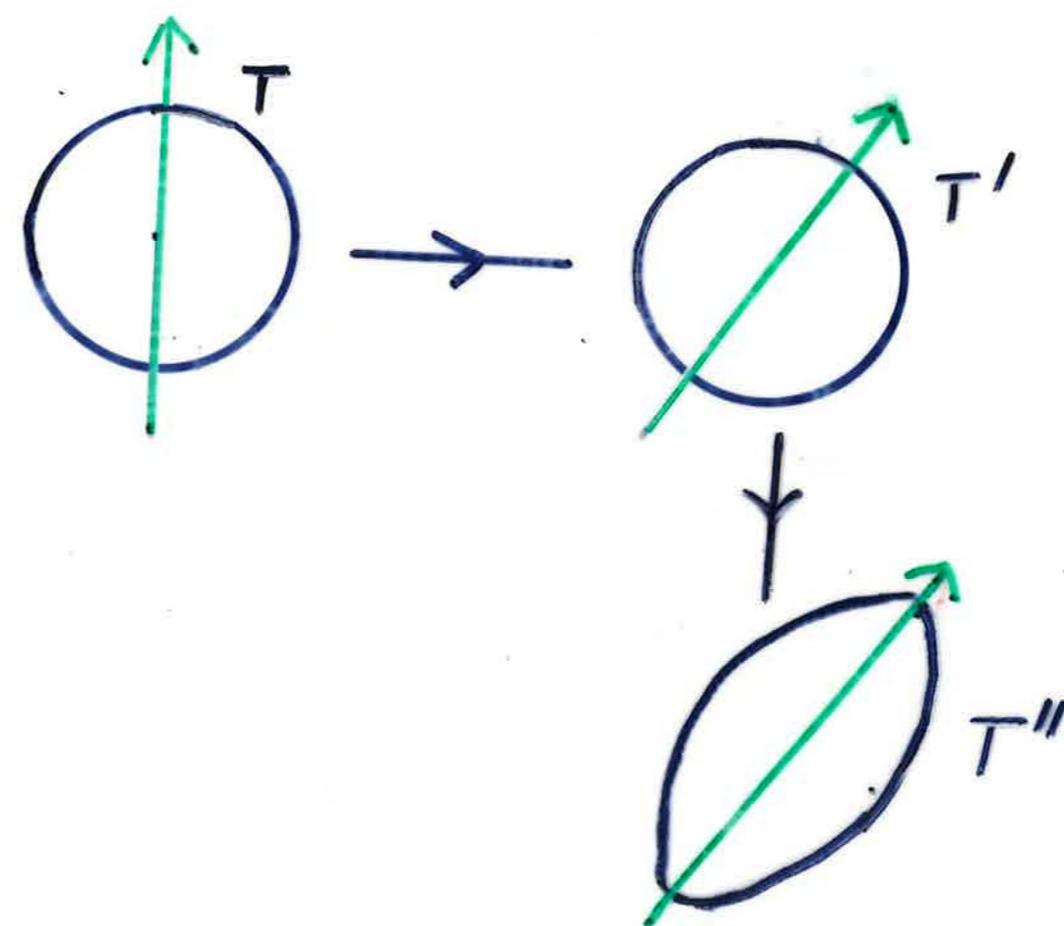
①

INPUTS TO QL.



(2)

REFORMULATION
AND 'STRETCHING'



HISTORICAL DEVELOPMENT of QL.

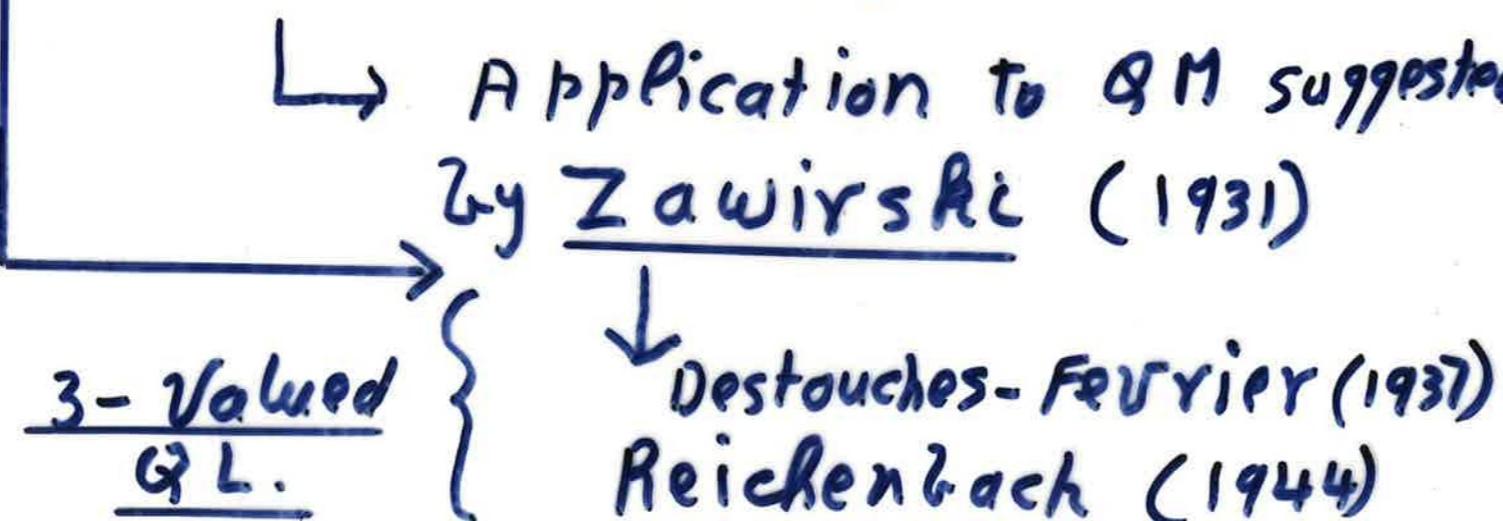
French Empinicist
School of Logic : Gonseth,
Bachelard etc

Many-Valued Logics

Technical development by
Łukasiewicz (1920) and Post (1921)

↳ Application to QM suggested

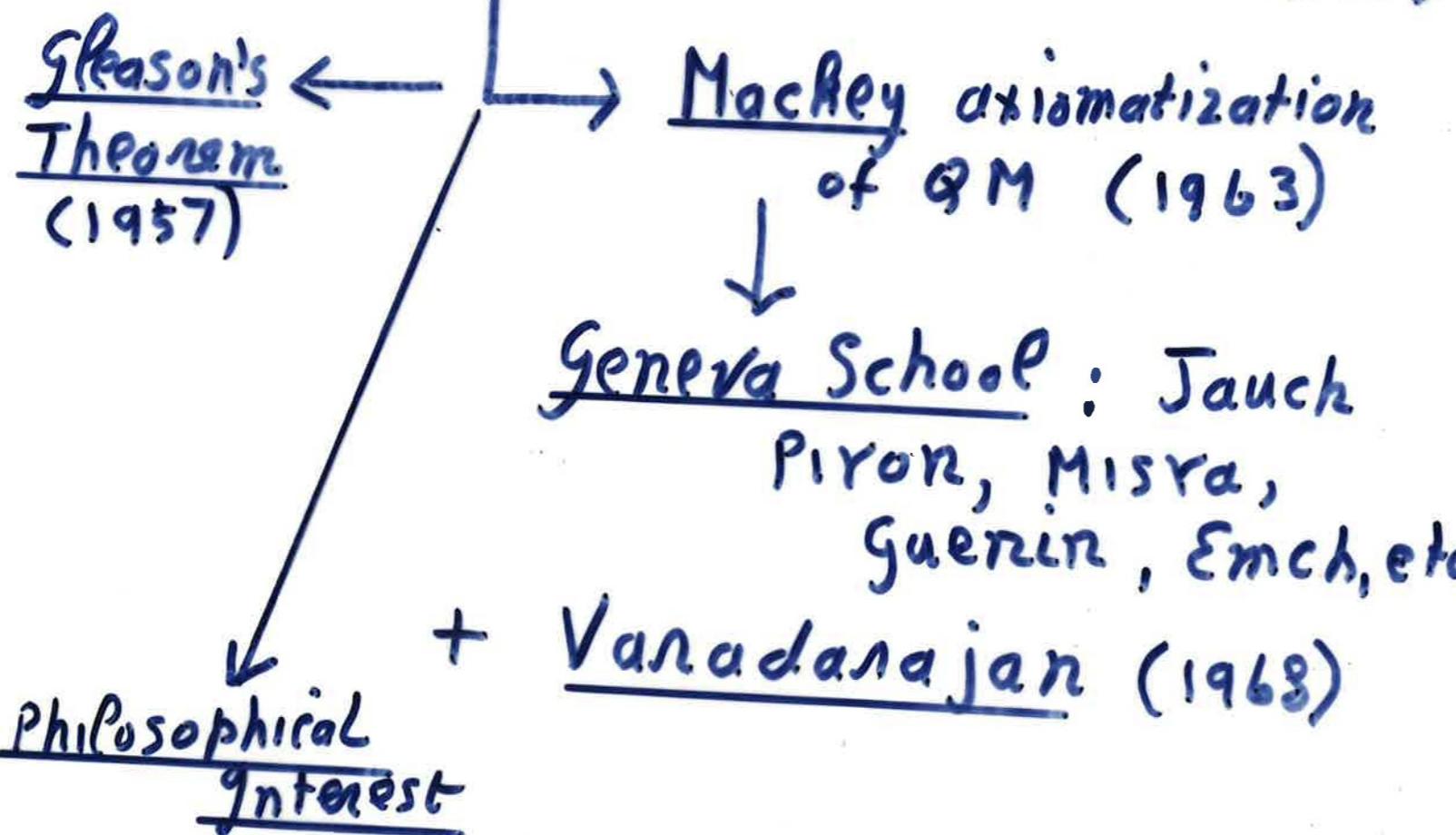
by Zawirski (1931)



↓
Supported by Putnam (1957)

• Non-Distributive QL

Birkhoff and von Neumann (1936)



- Specker (1960) — Q-Validity
- Finkelstein (1962) — operational QL.
- Putnam (1968) — Resolution of paradoxes.

• PUTNAM AND QUANTUM LOGIC

$$\frac{\text{Geometry}}{\text{GR}} = \frac{\text{Logic}}{\text{QM}}$$

$$L + P' = L' + P$$

old Logic ↑ Now Logic ↑
 new physics
 (paradoxes) old Physics
 (classical realism
 - no paradoxes)

LOGIC IN CLASSICAL PHYSICS

Phase space of Universe is

$$\tilde{\Sigma} = \bigcap_{\lambda \in I} \Sigma_\lambda$$

I is set of all particles and fields

Elementary proposition q associates representative point of the Universe with subset Q of $\tilde{\Sigma}$.

Compound propositions:

p or q associated with $P \cup Q$

p & q $P \cap Q$

$\sim p$ $C P$

Thus $P(\tilde{\Sigma})$ serves as characteristic algebra for CPC.

LOGIC AND SET THEORY

Set Theory based on Logic:

$$\tilde{A} = \{y : A(y)\}, \text{etc.}$$

$$\tilde{A} \cup \tilde{B} \underset{\text{Df.}}{=} \{x : x \in \tilde{A} \vee x \in \tilde{B}\}$$

$$\tilde{A} \cap \tilde{B} \underset{\text{Df.}}{=} \{x : x \in \tilde{A} \wedge x \in \tilde{B}\}$$

$$C\tilde{A} \underset{\text{Df.}}{=} \{x : x \notin \tilde{A}\}$$

Logic based on Set Theory:

$$A(x) \vee B(x) \underset{\text{Df.}}{=} x \in [\tilde{A} \cup \tilde{B}]$$

$$A(x) \wedge B(x) \underset{\text{Df.}}{=} x \in [\tilde{A} \cap \tilde{B}]$$

$$\sim A(x) \underset{\text{Df.}}{=} x \in [C\tilde{A}]$$

PUTNAM AND THE PARADOXES

ψ_n : Oscar has position n

ϕ_s : Oscar has momentum s

$$S_1 : (\psi_1 \vee \psi_2 \dots \vee \psi_n) \wedge (\phi_1 \vee \phi_2 \dots \vee \phi_n)$$

$$S_2 : (\psi_1 \wedge \phi_1) \vee (\psi_1 \wedge \phi_2) \dots \vee (\psi_1 \wedge \phi_n)$$

$$(\psi_n \wedge \phi_1) \vee \dots \vee (\psi_n \wedge \phi_n)$$

In C.L. $S_1 \equiv S_2$,

In Q.L. $S_1 \equiv I \wedge I = I$

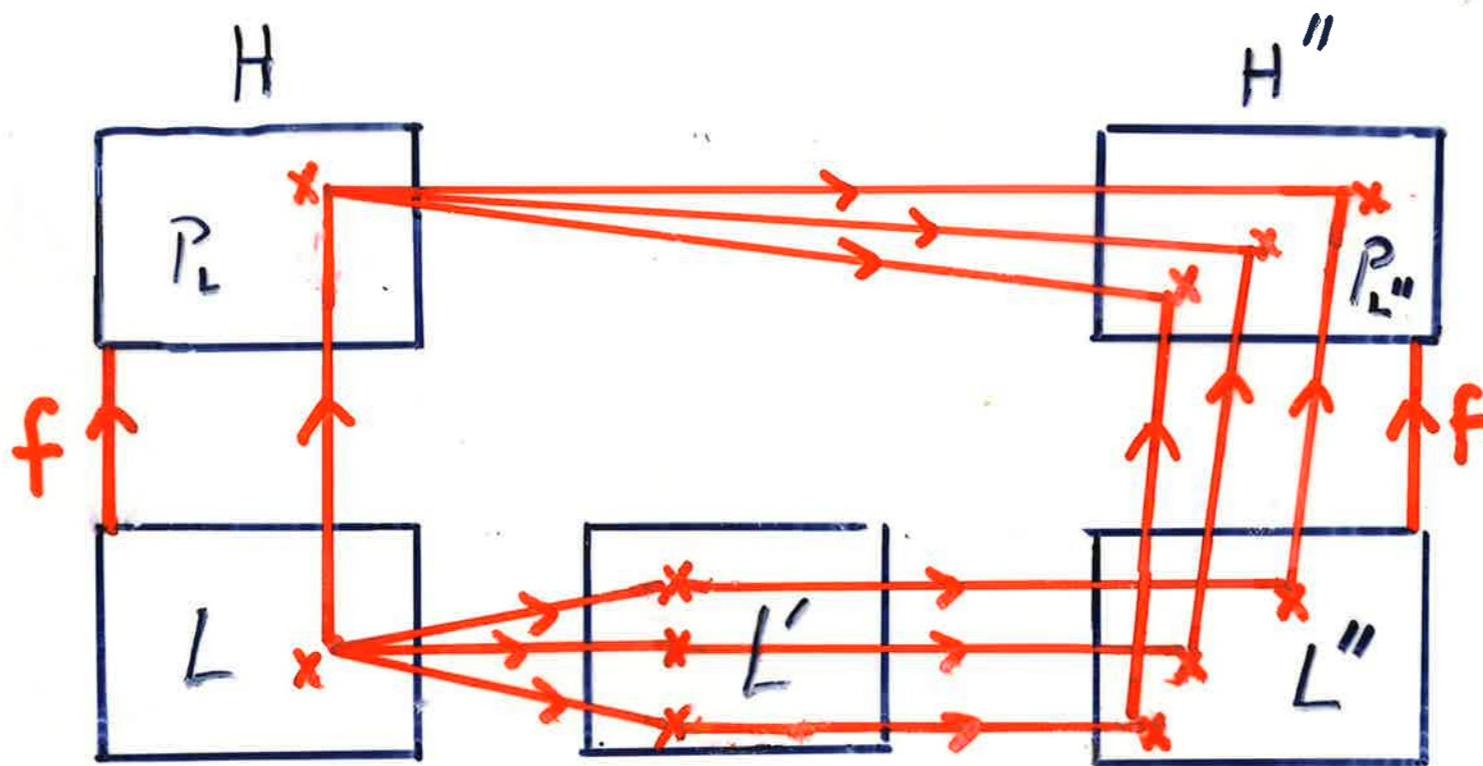
$$S_2 \equiv O \vee O \vee \dots = O$$

According to Putnam

S_1 says $(\exists x) q(x) \wedge (\exists y) p(y)$

S_2 says $(\exists x)(\exists y)[q(x) \wedge p(y)]$

QUANTUM STATES
AND PUTNAM STATES



Props
about
QM states

Props
about Values
of observables

Props
about
Putnam
states